tion being exactly balanced by a special form of Bronson's "air resistance." The special feature of the arrangement is that the radium standard is mounted on an optical bench at a distance from a lead ionisation chamber, and the distance is varied until exact balance is obtained. The strengths of different preparations are proportional to the square of the distances, correction being made for air absorption of the γ-rays. Each method naturally has its own advantages and range of applicability.

After comparisons by both methods, the gratifying result was arrived at that the Paris and Austrian standards agreed perfectly with one another within the limits of error of the measurements. Naturally, to obtain the highest possible accuracy with the methods, a much more extended series of measurements than was possible in the short time available would have been necessary. But it was clear that the error of measurement was certainly not greater than 1 part in 300, and was probably much less. For example, for two single comparisons, the 31·17 mg. Vienna standard came out as 31·24 mg. and the 10·11 mg. as 10·13 mg. in terms of the Paris standard. The standards being entirely independent, this result reflects the greatest credit on the care and accuracy bestowed by Mme. Curie and the other investigators responsible for their preparation and for the methods of measurement. In future it will be possible to evaluate the quantity of radium in a preparation, in the absence of other radioactive substances giving γ-rays, by simple γ-ray comparison with these standards without any chemical operations and without opening the tube in which it is sealed, with an accuracy of at least 3 or 4 parts in 1000.

The committee also had the advantage of having a standard, sent by Sir William Ramsay, and prepared from material employed in the just-published atomic weight determinations by him in conjunction with Whytlaw Gray (Proc. Roy. Soc., 1912, 86 A, 270). The quantity of radium was much smaller than in the others, and corresponded to less than 4 mg. of radium chloride. In addition, it was not comparable, either in the manner of its preparation or of its mounting, with the others, the tube in which it was contained being of quartz, relatively thick in the wall. For these reasons no definite comparison was possible of the same degree of accuracy as for the others.

The committee accepted Mme. Curie's standard as the International Radium Standard, and will ask for its preservation in the Bureau International des Poids et Mesures in Paris. They have arranged for the 31·17 mg. Austrian standard to be similarly preserved in Vienna as a reserve standard. These standards are hereafter only to be used for purposes of comparison by the committee, and are not to be taken away from the cities mentioned or to be used for experiment. Arrangements have been made for the preparation of secondary standards, of between 10 and 40 milligrams of radium chloride, to be provided to the Governments of the various countries desiring them for their official testing institutions. These secondary standards will be compared independently at Paris and Vienna with the international and reserve standards, and will be supplied with a certificate showing the result of the comparisons. Further particulars may be obtained from the secretary of the committee, Prof. Stefan Meyer, Institut für Radiumforschung, Waisenhausgasse 3, Wien IX, Austria.

In the course of a few months it will be possible for each country to possess a radium standard which has been compared directly with the international standard, which will enable measurements to be made in future with complete confidence and will be invaluable both for scientific and commercial comparisons.

The necessity of refunding to Mme. Curie a quantity of radium equivalent to that contained in the international standard has been a source of anxiety to the committee, who have no funds at their disposal. It is therefore most satisfactory to be able to announce that as soon as the need was made known, the sum necessary was generously donated in this country by Dr. and Mrs. G. T. Beilby as a personal tribute to Mme. Curie and her work.

NOTES.

The *Terra Nova*, the vessel of the British Antarctic expedition, arrived at Akaroa, New Zealand, on April 1, and brought the news that on January 3 Captain Scott and five other members of the expedition were within 150 miles of the south pole, and that he intends to remain another year in the Antarctic. A detailed account of the work accomplished by the expedition has been obtained by the Central News, Ltd., agency, and appeared in the daily papers on Tuesday and Wednesday. Captain Scott left the base at McMurdo Sound on November 2, 1911, for the poleward journey, and had arrived at latitude 87° 32′ S. on January 3. Nearly three weeks before this date Captain Amundsen had reached the south pole. Though Captain Scott has thus been forestalled as regards the first arrival at lat. 90° S., the scientific results of the British expedition promise to make up for any disappointment which may be felt from the point of view of national sentiment. Specimens of coal of economic value, and well-preserved fossils, have been found near Granite Harbour by the western geological party. Marine biological work has been carried on continuously, and every phase of seal, penguin, and skua-gull life has been photographed with the kinematograph. By means of small balloons the direction of atmospheric currents has been studied up to a height of six miles, and the temperatures have been recorded up to a height of five miles. Valuable magnetic, electrical, tidal, pendulum, and other observations relating to terrestrial physics have been made, and much has been done also in the fields of ice work and physiography. A summary of scientific work accomplished was published yesterday, and we hope to refer to its details next week. Meanwhile, we offer to Captain Scott and the other members of the British Antarctic expedition the thanks of the scientific world for the attention being given to systematic observations, which are of far greater value than the attainment of the south pole. By deciding to spend another winter in the Antarctic, Captain Scott has given us additional cause to be grateful to him, and we may look forward confidently to a harvest of results of prime importance when the expedition returns to civilisation next year.

A summary of the weather for the first quarter of the present year, as shown by the results for the thirteen weeks ended March 30th, issued by the Meteorological Office shows that the conditions were generally mild and wet over the United Kingdom. The mean temperature for the whole period was everywhere above the normal, the greatest excess occurring in the eastern and midland districts of England. The aggregate rainfall was in excess of the average everywhere, except in the north of Scotland, where the deficiency was rather more than 3 in. The largest total measurement of rain was 13·56 in. in the south-west of England, where the excess on the average was 4·15 in. The next greatest excess was 3·54 in. in the Channel Islands, and this was followed by 3·28 in. in the midland counties and 3·05 in. in the south-east of England. The largest number of rainy days in any district was 72 in the south of Ireland and 70 days in the south-west of England. The number of rainy days was in excess of the average in all districts, except in the north of Ireland. The duration of bright sunshine for the period was everywhere deficient, except in the north of Scotland, where there was a slight excess. At Greenwich the mean temperature for the three months was 44°, which is 3·5° in excess of the average, and it was 3·5° higher than for the corresponding period in 1911. The mean temperature was in excess of the average in each month, the excess for the three months being respectively 1·7°, 3·7°, and 4·7°. The aggregate rainfall for the three months at Greenwich was 7·18 in., which is 2·30 in. more than the average; the excess of rain in the three months was respectively 1·07 in., 0·11 in., and 1·12 in. The total duration of sunshine at Greenwich was 159h., which is 28h. less than the normal, the deficiency in the three months being respectively 6h., 14h., and 8h.

The crisis through which the country has passed during the last few weeks in relation to its fuel supply should expressly bring home to us the necessity for a more general appreciation of what lies ahead, and at no distant future, in the possible exhaustion, or at least very restricted output, of our coal measures. Many have directed attention to this grave problem, but the public attitude has been one of indifference, or, at most, a pious hope that something will replace coal. A useful pamphlet on "Natural Sources of Energy," being the report of a committee of the British Science Guild, just issued by the guild, appears at a particularly opportune moment, emphasising as it does the improbability of that useful find within the horizon of scientific knowledge and the need of serious efforts to check that enormous waste of coal which characterises our present methods. As Dr. Beilby shows, the saving by adoption of scientific methods might amount to 40 to 60 million tons per annum. How the turbine, gas-producer, and gas-engine—especially with utilisation of blast-furnace and coke-oven gas, so much of which is annually wasted or inefficiently utilised—can contribute to this economy is clearly shown. Oil engines, especially of the Diesel type, are shown to give high efficiency, but the enormous economic question of supply and output are clearly dealt with by Sir Boverton Redwood, according to whom the total crude oil output used under the best conditions is only equal to 15 per cent. of the coal. Other contributors to the report are Sir William Ramsay, the Hon. R. J. Strutt, Prof. V. B. Lewes, Mr. Dugald Clark, Sir Charles Parsons, and Mr. W. F. Reid.

The photography of colour by purely optical means, that is, without the use of pigments, dyes, or coloured screens, has been shown to be possible in two or three different ways. One of these methods was described and demonstrated with remarkable success by Messrs. Julius and Ernest Rheinberg at a meeting of the Royal Photographic Society held last week. These gentlemen have eliminated the practical difficulties of the process one at a time, and by their patient perseverance have produced a camera that conveniently serves for the taking of the photographs, for the viewing of them by means of an eyepiece, or for the projection of them upon a screen. An image of the view or object to be photographed is produced upon a ruled plate that has transparent lines alternating with much wider opaque lines. Behind the lined screen is a low-angled compound prism, so constructed and adjusted that it disperses the light that passes through each transparent line into a spectrum, which covers the otherwise blank space that corresponds to the adjacent opaque line. The whole surface, therefore, instead of being white and black is covered with these long, narrow spectra, which are narrow enough to be indistinguishable to the unaided eye, however the final picture is viewed. These spectra serve the same purpose as the three colours of an autochrome plate. A second lens focusses the image on to the photographic plate, which thus becomes a record of the original and all its colours. The optical part of the apparatus is so compactly arranged that it is all contained in a tube that is rather longer than a moderate-sized lens mount. Landscapes from nature, portraits, copies of pictures, photographs of jewellery, and of other subjects showed that the resulting colours were wonderfully true to the originals.

Mr. C. E. Adams has been appointed Government astronomer for the Dominion of New Zealand.

Prof. E. Metchnikoff, assistant director of the Pasteur Institute at Paris, has been elected foreign associate of the French Academy of Sciences, in succession to Sir Joseph Hooker.

The Turin Academy of Sciences has awarded the Vallauri prize of 800*l.* for contributions to the progress of physics in the period 1907–1910 to Prof. A. Righi and Prof. J. Perrin.

The council of the Manchester Literary and Philosophical Society has nominated the president, Prof. F. E. Weiss, to represent the society at the celebration of the 250th anniversary of the foundation of the Royal Society.

Prof. H. F. Newall, F.R.S., has been elected a member of the Athenæum Club under the provisions of the rule which empowers the annual election by the committee of a certain number of persons "of distinguished eminence in science, literature, the arts, or for public services."

Sir David Gill, K.C.B., F.R.S., has succeeded Lord Cromer as president of the Research Defence Society; and Lord Cromer, Mr. Balfour, Sir Edward Elgar, O.M., Mr. Rudyard Kipling, and Lord Rayleigh, O.M., have consented to be vice-presidents of the society.

The death is announced, at the early age of thirty-nine, of Dr. T. H. Montgomery, jun., professor of zoology in the University of Pennsylvania. He had been assistant professor at the same University from 1898 to 1903, and professor at the University of Texas from 1903 to 1908. He was the author of an "Analysis of Racial Descent in Animals," and of numerous monographs on biological subjects.

Prof. Ralph S. Tarr, of Cornell University, has died suddenly of cerebral hæmorrhage. He was born at Gloucester, Mass., in 1864, and graduated at Harvard. He served for a while at the Smithsonian Institution, and in connection with the United States Geological Survey. He went to Cornell in 1892 as assistant professor of geology, and had since held successively the chairs of dynamical geology and physical geography. He had written a "Physical Geography of New York State," in addition to several valuable text-books of geology and physical geography. His special work was done in the study of earthquakes and glaciers, upon which he wrote a number of important papers.

The death is announced of Mr. Charles Edward Leeds, who made the first part of the remarkable collection of fossil reptiles from the Oxford Clay of Peterborough which now occupies a large portion of a gallery in the British Museum (Natural History). Mr. Leeds attended the lectures of the late Prof. John Phillips, and some of his earliest discoveries were described in the professor's "Geology of Oxford." He left England in 1887 to spend the remainder of his life in New Zealand, and since his departure the collection has been extended by his brother, Mr. Alfred N. Leeds, who still resides at his birthplace, Eyebury, Peterborough.

We regret to see the announcement of the death of Prof. P. N. Lebedew, professor of physics in the University of Moscow, who first succeeded in 1901 in demonstrating the pressure of light experimentally. Maxwell pointed out that the concentrated rays of an electric lamp falling on a thin metallic disc, delicately suspended in a vacuum, might perhaps produce an observable mechanical effect. This effect was thought to have been obtained in the Crookes's radiometer, but the magnitude proved many thousand times too great. Prof. Lebedew eliminated the radiometer action by using a large bulb with high exhaustion, and by excluding rays capable of heating the tube walls. His investigations proved that light exerts a true pressure on a surface on which it is incident, and the absolute magnitude of the pressure was found to be equal to that predicted by Maxwell. Prof. Lebedew's work led other investigators to take up the subject of the mechanical pressure of light, and the results obtained have been most valuable and suggestive.

The annual general meeting of the Chemical Society was held at Burlington House, W., on Thursday, March 28, Prof. Percy F. Frankland, F.R.S., the president, occupying the chair. The adoption of the report of the council on the progress of the society during 1911 was carried, and the president presented the Longstaff medal for 1912 to Dr. H. Brereton Baker, F.R.S. The president then delivered his address, entitled "Some Stereochemical Problems." Prof. Percy F. Frankland was re-elected president; Prof. E. J. Mills, F.R.S., and Prof. G. T. Morgan were elected vice-presidents; Dr. S. Smiles as hon. secretary, and Dr. H. G. Colman, Dr. A. Harden, F.R.S., Dr. T. M. Lowry, and Dr. E. J. Russell as new ordinary members of council.

The sixty-fifth annual general meeting of the Palæontographical Society was held in the Geological Society's rooms at Burlington House on March 22, Dr. Henry Woodward, F.R.S., president, in the chair. The annual report referred to the completion of the monograph of English Chalk fishes, and of the second volume of that of Pleistocene mammalia. It also acknowledged the help of the Carnegie Trust for the universities of Scotland in providing the plates for another instalment of Dr. Traquair's monograph of Carboniferous palæoniscid fishes. A special effort had been made to complete works in progress before beginning new undertakings. Miss Margaret C. Crosfield, Mr. George Barrow, Mr. H. R. Knipe, and Prof. W. W. Watts were elected new members of council. Dr. Henry Woodward, Dr. George J. Hinde, and Dr. A. Smith Woodward were re-elected president, treasurer, and secretary respectively.

The Easter Vacation Classes and the number of workers at the Port Erin Biological Station promise this year to be considerably larger than on any previous occasion. Seventy-six senior students or post-graduate researchers in zoology, botany, or physiology (representing six universities) have now engaged work-places at the laboratory during April, and all the accommodation in the institution seems likely to be taxed to its utmost capacity. Planktologists elsewhere may be interested to know that the vernal phytoplankton has made its appearance in the Irish Sea this year at an earlier date than usual. Diatoms were present in great force in the plankton of Port Erin bay on March 18 for the first time this spring. On the other hand, this season's prospects in the hatchery are unfavourable. The spawning of the plaice in the ponds is later than usual, and the number of eggs produced is comparatively small.

The whole of the famous collection formed by the Rev. Canon Norman, F.R.S., consisting of North Atlantic and Arctic invertebrates other than insects, arachnids, and myriopods, has now become the property of the Natural History Museum, the fourth and last instalment having been received recently at Cromwell Road. The extent of this consignment may be judged when we state that of Mollusca there were specimens in 7114 glass-topped boxes, of Crustacea there were 7376 bottles and tubes containing specimens, and there were, in addition, 5544 microscopical slides. The Polyzoa were contained in 1063 glass-topped boxes, while there were 497 spirit specimens and 185 microscopical slides. The "lower invertebrata" were numerously represented in the earlier instalments. Students who desire to examine any specimens in the Norman collection should apply to the keeper of the Department of Zoology at South Kensington.

Announcement has been made of the following awards just decided by the council of the Royal Geographical Society:—With the approval of the King the two Royal medals have been awarded to Mr. Charles Montagu Doughty and Mr. Douglas Carruthers, the founder's medal to the former, in recognition of his explorations in Arabia, and the patron's medal to the latter, for his expedition in north-west Mongolia, including the upper basin of the Yenesei, the Altai mountains, and neighbouring regions, and for other explorations. The Victoria medal, for scientific research in geography, has been awarded to Sir George H. Darwin, K.C.B., F.R.S.; the Murchison bequest to Captain W. C. Macfie, R.E., who was appointed to the charge of the Uganda Topographical Survey in 1908, and in twenty months surveyed an area of 14,000 square miles; the Gill memorial to Captain F. M. Bailey, who in 1904 accompanied the expedition from Lhasa through Tibet, and last year travelled from the valley of the Yangtse westward to Sidiya, passing through about three hundred miles of unexplored country; the Cuthbert Peek fund to Mr. Cecil Clementi, who has travelled extensively in Central Asia, and made a careful series of astronomical observations for latitude and chronometric differences of longitude during his journeys; the Back bequest to Mr. L. A. Wallace for his explorations and surveys of the Tanganyika Plateau and the country round it.

At Hull, on Saturday last, March 30, a museum devoted entirely to objects connected with the fishing and shipping industries, which play so prominent a part in the city, was opened to the public. The museum, which is a large building, and top-lighted, is the gift of Mr. C. Pickering, J.P. The exhibits, which have been arranged by the curator, Mr. T. Sheppard, include an exceptionally fine series of harpoons, harpoon guns, flensers, blubber-spades, and other objects connected with the old whaling trade, which commenced at Hull in the sixteenth century, and may be said to have started the present flourishing oil and fishing industries. There are also dozens of models of ships, illustrating the evolution and growth of the vessels from the old "wooden walls" to modern battleships and liners, all built at Hull. The various phases in the evolution of the old fishing smack to the modern steam trawler are also shown by models. A valuable set is shown of Eskimo boats and fishing appliances, brought to Hull during the early part of last century, by the old whalers. Preparations are exhibited showing the growth of the prawn, trout, eel, carp, oyster, &c., and others illustrating the nervous system, blood-vessels, skeleton, and other parts of fishes. There is a representative set of skeletons of whales and fishes, large and small, and a large number of mediæval and later earthenware vessels, which have been dredged up from the Dogger Bank by the Hull trawlers.

In the *National Geographic Magazine* for January Mr. F. E. Johnson describes the remarkable series of Greek bronzes discovered by M. A. Merlin in 1907 in the wreck of a sunken galley near the little town of Mahdia on the coast of Tunis. The almost life-size statue of Eros attributed to Praxiteles is a wonderfully beautiful object, and it is almost equalled by the Running Satyr and the Hermes of Boethus, the Chalcedonian. There seems good reason to believe that this galley was chartered to convey to Rome the spoils of Athens after the attack by Sylla in 86 B.C., just as Mummius appropriated for himself, his friends, and the temples of Rome the spoils of Corinth. It is very creditable to M. Merlin, director of antiquities and fine arts in Tunisia, that with little assistance from his Government and by means of very rude appliances he has been able to recover this wonderful collection of works of art.

In the Bulletin of the Royal Academy of Sciences of Belgium (1912, No. 1, pp. 8–9) Prof. L. Dollo describes the remains of a fresh-water tortoise of the genus Podocnemis, from the Lower Eocene of the Enclave de Cabinda, Congo State. Although now restricted to tropical South America and Madagascar, the genus is represented in the Eocene of England, India, the Fayum, and the Congo, and would thus seem to have reached its present isolated habitats from the north.

Starting with the premiss that an increase in the weight and dimensions of a flying animal involves a still greater increase in the power necessary to drive the animal through the air, and that in consequence a limit is soon reached under existing physical conditions beyond which flight is impossible (such limit having probably been approximately attained by the largest existing flying birds), Messrs. E. and A. Harlé, in a paper published in vol xi., p. 118, of the *Bull. Soc. Géol. France,* urge that the power of flight possessed by the giant pterodactyles of the Cretaceous and the huge dragonflies of the Carboniferous was due to an augmentation of the atmospheric pressure as compared with that of the present day.

In a recent paper published in the Bulletin of the Imperial Academy of Sciences of St. Petersburg (February, 1912, pp. 219–236), Prince Galitzin considers the dispersion and damping of the seismic surface-waves due to the friction of the displaced material. He concludes that the velocity with which the waves spread over the surface decreases as the period of the waves increases, from 3·70 kms. a second with a period of one second to 3·07 kms. a second with a period of forty seconds.

The last four numbers of the *Bollettino* of the Italian Seismological Society contain the notices of the earthquakes recorded in Italy during the first 10½ months of 1908. Even for so short a time the catalogue contains accounts of more than 500 local shocks and ninety-four distant earthquakes. Among the former, it is interesting to note the frequent recurrence of the names of Messina, Reggio, and other places ruined towards the close of the year, pointing to the gradual preparation for the great earthquake which was unheralded by warning tremors. The eruption of Etna in 1908 was accompanied by a remarkable series of earthquakes, of which full details are given. Under the editorship of Dr. G. Martinelli, the catalogue has been recently enlarged and improved. If, however, to the details usually given for each earthquake, the approximate position of the epicentre, the maximum intensity of the shock, and the dimensions of the disturbed area could be added, the value of the "notices" would be greatly increased.

Messrs. Negretti and Zambra have recently devised a new type of instrument for recording continuously the direction of the wind. The record is traced on the chart by means of a single pen actuated by the vane. The pen is carried by a pivoted lever, having at one end a roller engaging with the cam surface of a spiral groove, which is attached to the spindle of the vane. As the vane rotates, the lever moves up or down and the pen records the motion on an appropriately ruled chart. In order to surmount the difficulty introduced by continuous rotation in one direction, the cam is provided at the highest point with a gap through which the lever falls, while at the lowest point a spring is brought into action by a secondary cam, and raises the lever. This arrangement involves duplicate points on the chart, and for half the compass the pen may be in one of two positions. This is a disadvantage which will probably be removed in the course of time. The makers are to be congratulated on the ingenious manner in which the primary difficulty has been overcome.

According to hydrodynamical theories, wave motion in deep liquids is accompanied by a gradual displacement of the liquid as a whole, this displacement being greatest at the surface. A general investigation, embracing an extension of Stokes and Rayleigh's theorems, is given by Prof. T. Levi Civita in the *Atti dei Lincei,* xxi., 1, for the case of waves in canals of any type whatever.

Messrs. E. Leitz have sent us a large wall-diagram which they have issued illustrating the construction and optics of the microscope. The mechanical parts and lenses are drawn in section, so as to show their construction, and coloured lines depict the paths of the rays of light through the optical system and the formation of the magnified image. The diagram should be very useful in laboratories for demonstrating to students the construction and optics of the instrument. A descriptive pamphlet is issued with it.

Bulletin No. 53 of the University of Illinois deals with the inductance of compact coils of wire without iron cores, and is written by Prof. Brooks and his assistant, Mr. Turner, for the use of engineers. It collects together a large amount of information as to the dimensions and weights of bare and cotton- or silk-covered wire, and gives a general formula for the inductance of coils of almost any shape the wire of which is wound without considerable spaces between the turns. If l is the length of wire on the coil, R the outer radius, b, the length, and c the radial depth of the coil, the self-inductance

$$L = \frac{l^2}{b+c+R} \times \frac{10b+12c+2R}{10b+10c+1{\cdot}4R} \times 0{\cdot}5 \log\left(100 + \frac{14R}{2b+3c}\right) \times 10^{-9} \text{ henries.}$$

The ratios of the dimensions which give the maximum inductance for a given length of wire are $b : c : R = 12 : 10 : 20$. The inductance formula has been tested on nineteen coils of different shapes, the inductances of which were determined at the Bureau of Standards, and in no case was the calculated value so much as 3 per cent. different from the observed.

According to theory, two stereoisomers of symmetrical dichloroethylene should exist. Two symmetrical diiodoethylenes are known, and in the *Comptes rendus* of the Paris Academy of Sciences for March 18, G. Chavanne describes the isolation of the corresponding chlorine derivatives, hitherto unknown. Commercial dichloroethylene was fractionated in a Young column of eight sections, and was separated into approximately equal amounts of two isomers, boiling at 49° C. and 60·2° C. respectively; both gave figures on analysis corresponding with the constitution $C_2H_2Cl_2$. Contrary to expectation, the dibromides $C_2H_2Cl_2Br_2$ obtained from each by the action of bromine are identical, and further work on the space relations of these isomerides is in progress.

An index to Nos. i.–xvi. of the *Annual* of the British School of Athens has been compiled by Mr. Arthur M. Woodward. Its main purpose is to make more accessible the contents of the reports of the excavations undertaken by the school, or in connection with it, especially those at Knossos, Palaikastro, and Sparta. The index may be obtained from Messrs. Macmillan and Co., Ltd., and its price is 10*s*. net.

Messrs. Watts and Co. have published for the Rationalist Press Association, Ltd., at the price of sixpence, a new and revised edition of Sir Ray Lankester's "The Kingdom of Man." The author has revised "the text so far as to alter here and there the terms of reference to events and discoveries which are now six years older than they were when the book was first printed." An improved figure showing the relative size of the cerebral hemispheres in the extinct mammal Dinoceras and large mammals now living has been substituted for that previously published.